

6.2 Slopes of Parallel and Perpendicular Lines



LESSON FOCUS

Use slope to determine whether two lines are parallel or perpendicular.

Make Connections

Look at the map.

Which streets are parallel to 11th Avenue?

Which streets are perpendicular to 11th Avenue? How could you verify this?



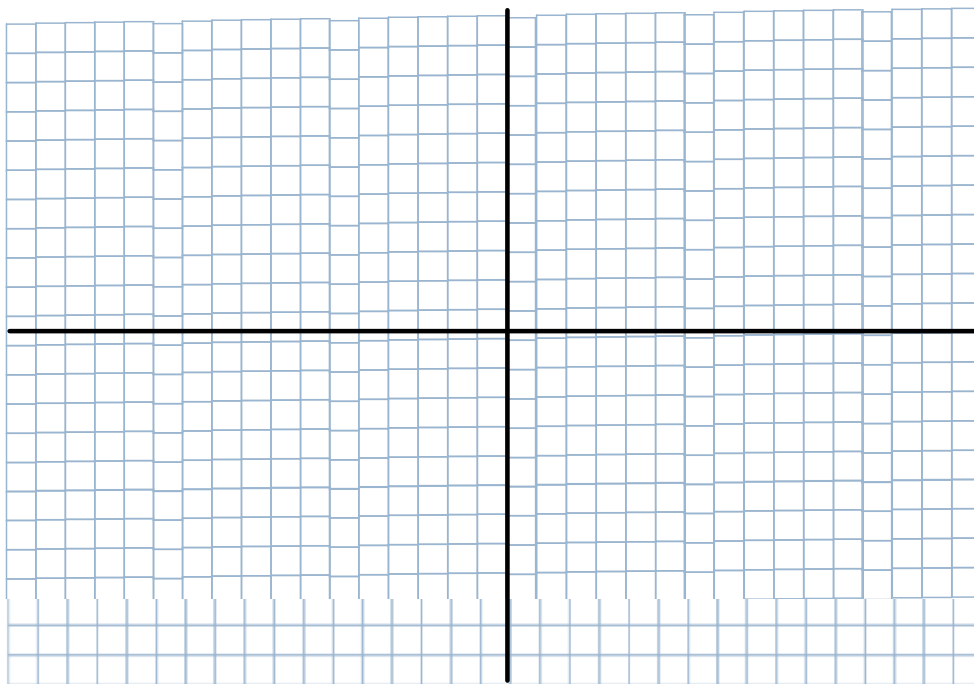
TRY THIS

Work on your own.

You will need grid paper and a ruler.

- On a coordinate grid, draw 2 squares with different orientations.
- For each square, determine the slope of each side.
 - What do you notice about the slopes of parallel line segments?
 - What do you notice about the slopes of perpendicular line segments?
- Compare your results with those of 3 classmates. Do the relationships you discovered in Step B seem to be true in general? Justify your answer.

Draw 2 squares with different orientations.
For each square, determine the slope of each side.



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What do you notice about the slopes of parallel line segments?

What do you notice about the slopes of perpendicular line segments?

Do the relationships you discovered about the slopes of parallel and perpendicular line segments seem to be true in general? Justify your answer.

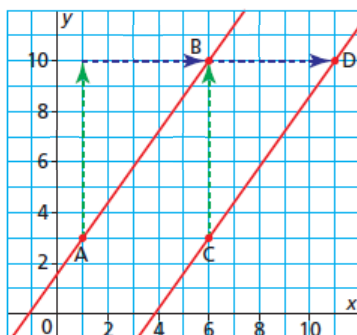
6.2 Slopes of Parallel and Perpendicular Lines

When two lines have the same slope, congruent triangles can be drawn to show the rise and the run.

Lines that have the same slope are parallel.

Slope of AB = ?

Slope of CD = ?



?



6.2 Slopes of Parallel and Perpendicular Lines

Example 1 Identifying Parallel Lines

Line GH passes through $G(-4, 2)$ and $H(2, -1)$. Line JK passes through $J(-1, 7)$ and $K(7, 3)$. Line MN passes through $M(-4, 5)$ and $N(5, 1)$. Sketch the lines. Are they parallel? Justify the answer.

1. Plot each line from above
2. Find the slope of each line

$$\begin{aligned} GH &= -\frac{1}{2} \\ JK &= -\frac{1}{2} \\ MN &= -\frac{4}{9} \end{aligned}$$



CHECK YOUR UNDERSTANDING

SOLUTION

6.2 Slopes of Parallel and Perpendicular Lines

Parallel Lines

Parallel lines have the exact same slope. The slope of line GH and JK were both $-\frac{1}{2}$ and therefore are considered parallel lines.

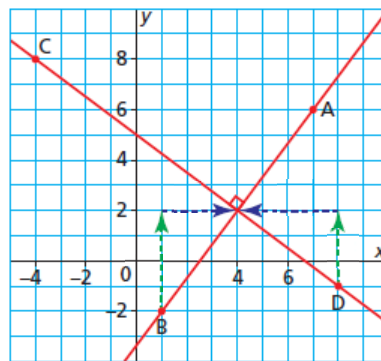
In order to prove that two lines are parallel, you need to find their slopes and show that they are equal.

Non-parallel lines in the same plane have different slopes. Perpendicular lines are not parallel, so they have different slopes.

Lines AB and CD are drawn perpendicular.

$$\text{Slope of AB} = \frac{\text{rise}}{\text{run}} \quad \text{Slope of CD} = \frac{\text{rise}}{\text{run}}$$

$$\text{Slope of AB} = ? \quad \text{Slope of CD} = ?$$



?





The relationship between the slopes of AB and CD is true for any two oblique perpendicular lines. Horizontal and vertical lines are an exception.

The slope of a horizontal line is 0. The slope of a vertical line is $\frac{1}{0}$, which is not defined. So, the slopes of horizontal and vertical lines are not negative reciprocals.

* Slopes of Perpendicular Lines

The slopes of two oblique perpendicular lines are negative reciprocals;

that is, a line with slope a , $a \neq 0$, is perpendicular to a line with slope $-\frac{1}{a}$.

$-\frac{3}{4}$ is the *negative reciprocal* of $\frac{4}{3}$

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Example 2 Examining Slopes to Compare Lines

Line PQ passes through $P(-7, 2)$ and $Q(-2, 10)$.

Line RS passes through $R(-3, -4)$ and $S(5, 1)$.

- Are these two lines parallel, perpendicular, or neither? Justify the answer.
- Sketch the lines to verify the answer to part a.

 **SOLUTION**



CHECK YOUR UNDERSTANDING

6.2 Slopes of Parallel and Perpendicular Lines

Example 3 Identifying a Line Perpendicular to a Given Line

- Determine the slope of a line that is perpendicular to the line through $E(2, 3)$ and $F(-4, -1)$.
- Determine the coordinates of G so that line EG is perpendicular to line EF .

 **SOLUTION**



CHECK YOUR UNDERSTANDING

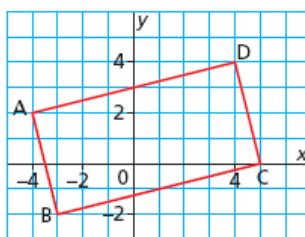


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Example 4 Using Slope to Identify a Polygon

ABCD is a parallelogram. Is it a rectangle? Justify the answer.

 **SOLUTION**



CHECK YOUR UNDERSTANDING

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pg. 349
3, 4, 5, 6, 8

Wednesday, Dec.14

- Check and go over homework Pg.349#3-6,8
- Begin Section 6.4 (Writing the equation of a line)
- Notes/Examples

Reminder: Please pass in yesterday's worksheet.
Chapter 6 Test on Wednesday, Dec.21

3. The slopes of lines are given below. For each line, what is the slope of a parallel line?

a) $\frac{4}{5}$

$\frac{4}{5}$

b) $-\frac{4}{3}$

$-\frac{4}{3}$

c) 3

3

d) 0

0



4. The slopes of lines are given below. For each line, what is the slope of a perpendicular line?

a) $\frac{7}{6}$ $-\frac{6}{7}$

b) $-\frac{5}{8}$ $\frac{8}{5}$

c) 9 $-\frac{1}{9}$

d) -5 $+\frac{1}{5}$



4 $-\frac{1}{4}$

negative
recip

6.2 Slopes of Parallel and Perpendicular Lines

5. The slopes of two lines are given. Are the two lines parallel, perpendicular, or neither?

a) $4, 4$ Para

b) $\frac{1}{6}, 6$ N

c) $\frac{7}{8}, -\frac{7}{8}$ N

d) $\frac{1}{10}, -10$ Per



$\frac{1}{8}$ $-\frac{8}{2}$

6.2 Slopes of Parallel and Perpendicular Lines

6. The slopes of lines are given below. What is the slope of a line that is:

i) parallel to each given line?

ii) perpendicular to each given line?

a) $-\frac{4}{9}$

b) 5

c) $\frac{7}{3}$

d) -4

$-\frac{4}{9}$ 5 $\frac{7}{3}$ -4
 $\frac{9}{4}$ $-\frac{1}{5}$ $-\frac{3}{7}$ $\frac{1}{4}$



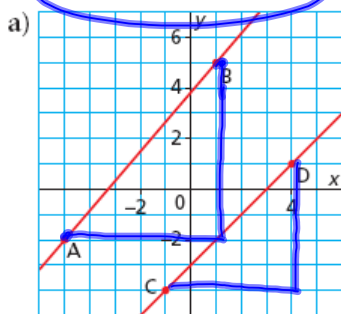
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8. For each grid below:

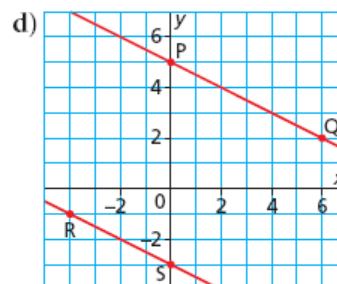
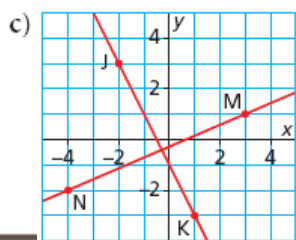
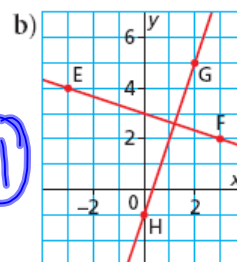
i) Write the coordinates of the 2 labelled points on each line.

ii) Are the two lines parallel, perpendicular, or neither? Justify your answer.

$$\frac{y_2 - y_1}{x_2 - x_1}$$



slope AB = $\frac{7}{6}$
 slope CD = $\frac{5}{5} = 1$



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